Remarks

Claims 1, 27, 28, 40 and 43 have been amended. Claims 5 and 14-26 are cancelled. Claims 30-39 were previously withdrawn. Accordingly, claims 1-4, 6-13, 27-29 and 40-50 are currently pending.

In the Office Action, the Examiner has reiterated the previous rejection of all of the previously pending claims, claims 1-29 and 40-50, under 35 U.S.C. §103(a) over Wood, U.S. Patent No. 4,455,248, and under 35 U.S.C. §103(a) over Newell, U.S. Patent No. 4,293,441.

Claims 1, 27 and 43 have been amended to recite that the heat transfer fluid contains more than 60 percent by weight ethylene glycol. Support for this amendment may be found in the specification at, for example, page 11, lines 17-21, and page 14, line 21 to page 15, line 5. Claim 1 has also been amended by adding to the preamble of the claim that the heat transfer fluid has a freezing point at atmospheric pressure of less than minus 10°C and a boiling point at atmospheric pressure of greater than 150°C. Support for this amendment may be found in the specification at, for example, page 15, line 19 to page 17, line 10. Claims 1 and 40 have been amended to recite that the heat transfer fluid contains no additives that require water to be present in the fluid to dissolve the additives or to otherwise enable the additives to function. Support for this amendment may be found at, for example, page 21, lines 5-15. Claim 28 has been amended to clarify that the concentration of the second diol in the heat transfer fluid is measured as a weight percentage of the total diols in the fluid.

As recited in claims 1-4, 6-13, 27-29 and 40-50 as amended, the present application is directed to a non-aqueous heat transfer fluid having reduced toxicity and methods for

reducing the toxicity of ethylene glycol based heat transfer fluids. As set forth in amended Claim 1, the heat transfer fluid comprises more than 60 percent by weight (of the total weight of diols in the fluid) ethylene glycol, at least one additional diol which acts as an inhibitor for ethylene glycol poisoning, and at least one corrosion inhibitor additive that is soluble in ethylene glycol and the additional diol. As further recited in claim 1 as amended, the heat transfer fluid contains no additives that require water to be present in the fluid to dissolve the additives or to otherwise enable the additives to function. Claims 2-4 and 6-13 depend, directly or indirectly, from claim 1 and further define embodiments of the invention. As set forth in claims 4 and 13, in one embodiment, the additional diol which acts as an inhibitor for ethylene glycol poisoning is propylene glycol.

As recited in claims 27-29 and claims 40-50 as amended, the present application is also directed to methods for reducing the toxicity of existing ethylene glycol based fluids by adding a second diol, such as propylene glycol, which reduces the toxicity of the ethylene glycol based fluid. As recited in claim 27 as amended, after addition of the second diol, the resulting heat transfer fluid contains more than 60 percent by weight (of the total weight of diols in the fluid) ethylene glycol.

As described in the specification at, inter alia, pages 11 and 14-15 and as recited in the amended claims, the heat transfer fluid of the present invention is used as a coolant without the addition of any water. As described in the specification at, inter alia, pages 15-17, the heat transfer fluids of the mixtures described and claimed in the present application exhibit the necessary physical properties, such as, for example, viscosity and vapor pressure, to function effectively in applications over a broad range of temperatures. The diols in the heat transfer

fluid recited in the amended claims serve as the heat transfer medium. Thus, the freezing point of the heat transfer medium is determined by the freezing point of the diols, and the boiling point of the heat transfer medium is determined by the boiling point of the diols. As a result, the heat transfer fluid has a freezing point at atmospheric pressure of less than minus 10°C and a boiling point at atmospheric pressure of greater than 150°C.

The heat transfer fluid recited in the amended claims is non-aqueous, meaning that water is not added or intended to be added to the fluid. Any water that is present is an impurity and would be present in very small amounts. Any such water would typically be removed from the fluid in use when the fluid is heated, as in an engine, because the water would be converted to vapor and vented from the system. Because water may only be present in very small amounts as an impurity, any water present in the fluid is insufficient to cause corrosion, and there is no need to include additives to prevent water-caused corrosion of internal surfaces, i.e. no inhibitors requiring water to remain in solution are necessary.

As set forth in the present application at pages 11 and 21, the only additives present in the heat transfer fluid of the present invention are completely soluble in the diols without the presence of any water. These additives remain dissolved in the fluid regardless of storage or use. The heat transfer fluids do not contain any additives that require water to be present to dissolve the additives or to otherwise enable the additives to function. As described in the specification at pages 7-9, prior art glycol based heat transfer concentrates required from 3% to 5% by weight water to dissolve additives that need water for solubility, such as metasilicate corrosion inhibitors. Even with 3% to 5% water, the water-requiring additives would often precipitate out of solution during storage of the concentrate, and if enough additional water

were not added to the concentrate to form the heat transfer fluid, the water-requiring additives would precipitate or gel during use at elevated temperatures.

Moreover, as described in the specification at, inter alia, pages 18-21, the non-aqueous heat transfer fluids of the present invention unexpectedly exhibit a reduced oral toxicity than would be predicted based upon the oral toxicity of the major components, such as ethylene glycol or propylene glycol.

Both of the references cited by the Examiner describe fluids that are intended for use by combining the fluid with water. Because water can cause corrosion of various materials in cooling systems, the fluids use corrosion inhibitor additives that require water for solubility. Therefore, as set forth in detail below, the fluids described in Wood and Newell, which are clearly used in aqueous heat transfer systems, necessarily must include sufficient water to maintain the water soluble additives in solution. Even when provided in the concentrated form, the fluids described in Wood and Newell inherently contain sufficient water to maintain the water soluble additives in solution. Accordingly, Wood and Newell do not teach or suggest to one skilled in the art a non-aqueous heat transfer fluid as recited in claims 1-4, 6-13, or a method for reducing the toxicity of a non-aqueous, ethylene glycol based heat transfer fluid as recited in claims 27-29 and 40-50.

Wood, U.S. Patent No. 4,455,248, describes an antifreeze composition for use in automotive cooling systems or other heat transfer services. Wood states that the composition "necessarily" contains sodium metasilicate. Col. 3, lines 27-55. Although states that "the antifreeze may be formulated as a concentrate using little or no water", (col. 3, lines 7-8), the requirement that the fluid described by Wood contain sodium metasilicate necessitates the

inclusion of sufficient water for the sodium metasilicate to dissolve and remain in solution, i.e. in order for the sodium metasilicate to function. See Declaration of John W. Evans submitted herewith at Paragraphs 4-5. Accordingly, for at least this reason, Wood does not teach or suggest a heat transfer fluid composition as recited in claims 1-4 and 6-13, which recite that the heat transfer fluid of the present invention contain no additives requiring the presence of water in the fluid. Also, Wood does not teach or suggest a method to reduce the toxicity of a non-aqueous, ethylene glycol based heat transfer fluid as recited in claims 27-29 and 40-50 as amended.

In addition, Wood states that the antifreeze composition is used in the heat transfer service by diluting the composition with water. Col. 3, lines 16-22. Thus, Wood describes a method using an aqueous heat transfer fluid, which is plainly different from the non-aqueous heat transfer fluid recited in the claims as amended. For this additional reason, Wood does not teach or suggest the use of a non-aqueous heat transfer fluid as recited in the methods in the amended claims.

Moreover, although Wood generally states that mixtures of glycols may be used in the anti-freeze compositions described therein, Wood does not teach or suggest combining ethylene glycol and propylene glycol in any specific proportions, much less in the proportions recited in the amended claims. As described in the application, the present inventors unexpectedly discovered that adding relatively small amounts of propylene glycol to ethylene glycol unexpectedly resulted in a non-aqueous heat transfer fluid having substantially reduced toxicity. Wood does not teach or suggest combining ethylene glycol and propylene glycol in any specific amounts, much less in the proportions recited in the amended claims.

Accordingly, for at least these reasons, the methods recited in the amended claims are not described, taught or suggested in Wood, and applicants respectfully submit that the rejection under 35 U.S.C. § 103(a) based upon Wood is traversed based upon the amendments to the claims.

Newell, U.S. Patent No. 4,293,441, is directed to a composition for minimizing corrosion of aluminum surfaces comprising ethylene glycol or propylene glycol and fluroaliphaticsulfonamidophosphonic acid or a salt thereof. Although Newell states in col. 1, lines 45-46 that the composition may contain "ethylene glycol, propylene glycol or mixtures thereof, including aqueous solutions thereof", Newell does not teach or suggest combining ethylene glycol and propylene glycol in any specific proportions, much less in the proportions recited in the amended claims. Indeed, all of the examples provided by Newell in the Description of Preferred Embodiments describe compositions containing only aqueous solutions of ethylene glycol.

The compositions described by Newell are not non-aqueous, as the compositions described in Newell require sufficient water to maintain the phosphonic acid salt in solution. At col. 6, lines 9-11, Newell notes that the phosphonic acid salts "are sufficiently soluble in aqueous solutions." Newell's sole reference to use with "little or no water" (col. 5, lines 63-66) refers only to the limited situation where the fluid is used "at elevated temperatures, for example above 100° C." Claims 1-4 and 6-13 as amended recite heat transfer fluids that operate over a broad range of temperatures, that require no added water, and that do not contain additives that need water in the fluid to function. Newell, on the other hand, teaches a fluid that requires the addition of water for operation below elevated temperatures, for

example, below 100° C. As set forth in the De claration of John W. Evans submitted herewith at Paragraph 3, these statements in Newell wouldlead one skilled in the art to conclude that the composition described by Newell is a usable fluid without added water only at elevated temperatures.

Moreover, Newell does not teach or suggest a method to reduce the oral toxicity of a non-aqueous, ethylene glycol based heat transfer fluid by addition of a second diol, such as propylene glycol, as recited in claims 27-29 and 40-50 as amended. In the methods of the present invention, the applicants unexpectedly discovered that a non-aqueous, ethylene glycol based heat transfer fluid could be substantially reduced in toxicity by addition of a second diol, such as propylene glycol, at levels far below what would have been predicted based upon the toxicity of the individual components of the fluid. Newell does not teach or suggest any particular combination of ethylene glycol and propylene glycol, much less combination of the two glycols in the ranges recited in amended claims 27-29 and 40-50, which result in a fluid having unexpectedly reduced oral toxicity.

Accordingly, for at least these reasons, the methods recited in the amended claims are not described, taught or suggested by Newell, and applicants respectfully submit that the rejection under 35 U.S.C. § 103(a) based upon Newell is traversed based upon the amendments to the claims.

In addition to the amendments discussed above, claims 1 and 27 have been amended to recite that the heat transfer fluids of the present invention must comprise more than 60 percent by weight (of the total weight of the diols in the fluid) ethylene glycol. Applicants point out that this amendment distinguishes the heat transfer fluid of the present

invention over the fluids described and claimed in the co-pending application serial number 10/629,642, published as Evans, US 2004/0099839 ("Evans").[1] Evans describes a non-aqueous heat transfer fluid for use in cooling engines. The heat transfer fluid described in Evans comprises non-buffered propylene glycol and at least one corrosion inhibiting additive selected from the group consisting of a molybdate salt, a nitrate compound and an azole compound. In Paragraph 0047, Evans states that the non-aqueous heat transfer fluid preferably contains only propylene glycol as a base liquid. Although Evans notes that the base fluid may contain both propylene glycol and ethylene glycol, Evans states that a mixture of propylene glycol and ethylene glycol "is not as beneficial as using [propylene glycol] alone due to increased toxicity. However, in order to retain the present invention's other characteristics, the mixture must contain at least 40% [propylene glycol]."

In the present application, the inventors unexpectedly discovered that an ethylene glycol based, non-aqueous heat transfer fluid could be substantially reduced in toxicity by addition of propylene glycol at concentrations much less than 40% propylene glycol, and that such a heat transfer fluid would function satisfactorily. The claims as amended recite that the heat transfer fluid must contain more than 60% by weight ethylene glycol, meaning the second diol, such as propylene glycol, must comprise less than 40% by weight of the non-aqueous heat transfer fluid. Because the claims as amended require more than 60% by weight ethylene glycol, the invention recited in the present claims are not the same invention as described in Evans. Indeed, Evans teaches away from the compositions and methods recited

[1] Application serial number 10/629,642 is a continuation-in-part of application serial number 08/991,155, which was described previously in the application at page 10.

in the amended claims, as Evans states that the heat transfer fluid described therein must contain at least 40% propylene glycol. Accordingly, the claims as amended distinguish over Evans.

In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes after considering these remarks, that the application is not in condition for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

Because the reasons above are sufficient to traverse the rejection, Applicants have not explored, nor do they now present, other possible reasons for traversing such rejections. Nonetheless, Applicants expressly reserve the right to do so, if appropriate, in response to any future Office Action.

A Request for Continued Examination and a Petition for Extension of Time Pursuant to 37 CFR § 136(a) with associated fees have been filed concurrently herewith. No additional fee is believed to be required. However, if a fee is required or otherwise necessary to cover any deficiency in fees previously paid, authorization is hereby given to charge our Deposit Account No. 50-3569.

Respectfully submitted,

Date: August 18, 2005

By: E. E. Grondahl
Eric E. Grondahl
Registration No. 46,741
Attorney for Applicant

PTO Correspondence Address:

McCarter & English, LLP
CityPlace I
185 Asylum Street
Hartford, CT 06103
Phone: (860) 275-6719
Fax: (860) 724-3397

HARTFORD: 646522.01